California Institute for Regenerative Medicine

Role of mechanical signaling in stem cell self-renewal and differentiation

Grant Award Details

Role of mechanical signaling in stem cell self-renewal and differentiation

Grant Type:	Basic Biology IV
Grant Number:	RB4-06102
Project Objective:	The overall goal is to exlore how mechanical cues, such as stretch, compression, or matrix stiffness, regulate hESC proliferation, self-renewal and differentiation, and to elucidate the molecular pathways through which this occurs.
Investigator:	**Name:** Alexander Dunn **Institution:** Stanford University **Type:** PI
Human Stem Cell Use:	Embryonic Stem Cell
Award Value:	$1,062,998
Status:	Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Reporting Period: Year 3

View Report

Reporting Period: Year 4/NCE

View Report

Grant Application Details

Application Title: Role of mechanical signaling in stem cell self-renewal and differentiation

Public Abstract:

Cells feel subtle but constant pushes and tugs from their neighbors inside living organisms. Surprisingly, these tiny mechanical cues have a profound effect on how stem cells grow, divide, and turn into the many different cells that make up the human body. Based on recent findings in developmental, cancer, and stem cell biology, we hypothesize that proteins known as cadherins, which allow cells to adhere to one another, are critical to the ability of stem cells to sense and respond to mechanical force. We will use a new form of microscopy to directly visualize the mechanical forces experienced by cadherins in living cells. This information will allow us to determine how stem cells detect force, and how they convert mechanical inputs into changes in gene expression that drive growth and differentiation.

Our work addresses two major, unsolved issues in stem cell biology: the factors that allow stem cells to turn into any kind of cell in the body, and the mechanism by which mechanical cues guide this process. This research will advance biology and medicine by teaching us more about how cells talk to each other using mechanical force, a topic about which very little is known. This project will have a potentially transformative impact on regenerative medicine by providing fundamental knowledge that will be directly applicable to new stem cell treatments, for example for heart disease, and for engineering new tissues to repair or replace diseased tissues or even entire organs.

Statement of Benefit to California:

Cells feel subtle but constant pushes and tugs from their neighbors inside living organisms. Surprisingly, these tiny mechanical cues have a profound effect on how stem cells grow, divide, and turn into the many different cells that make up the human body. However, at present we know almost nothing about how the input provided by mechanical force is connected to changes in stem cell behavior. Our research aims to fill this fundamental gap in our knowledge of how stem cells work. Understanding this aspect of their basic biology will be critical in developing new stem-cell-based treatments for heart disease, and for engineering new tissues to repair or replace diseased tissues and organs.